PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Tohru MORIYA Attn: PCT Branch

Application No. New U.S. Patent Application

Filed: September 28, 2006 Docket No.: 129606

For: TONER FOR DEVELOPING ELECTROSTATIC CHARGE IMAGES

TRANSMITTAL OF TRANSLATION OF THE ANNEXES TO THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Attached hereto is a translation of the annexes to the International Preliminary Report on Patentability (Form PCT/IPEA/409). The attached translated material replaces the material in the specification at pages 5-8, 22-24 and the claims in their entirety at pages 31-32.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

William P. Berridge
Registration No. 30,024

JAO:WPB/nxy

Date: September 28, 2006

OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461

superior in fixability in a high temperature range.

Another object of the present invention is to provide a toner for developing electrostatic charge images which is superior in melt contamination resistance in addition to the fixability.

MEANS FOR SOLVING THE PROBLEMS

[0009] The present inventor conducted research in order to solve the above problems, and as a result, he found that in a toner produced by melting and kneading at least alicyclic olefinic resin (A), thermoplastic elastomer (B), and a colorant, and by crushing and classifying the melted kneaded material, the temperature range in which the offset phenomenon and the winding phenomenon do not occur when fixing the toner is increased, and melt contamination resistance of the toner is improved and superior toner images can be formed, thereby accomplishing the present invention.

[0010] That is, the toner for developing electrostatic charge images of the present invention (hereinafter referred to as the "toner") comprises at least a binding resin and a colorant, wherein the binding resin contains an alicyclic olefinic resin (A) and a thermoplastic elastomer (B), ~~(Claim 1). It is preferable that~~ the alicyclic olefinic resin (A) is ~~be~~ a copolymer comprising a cyclic olefin (A1) and an acyclic unsaturated monomer (A2) as an element, and ~~(Claim 2). It is preferable that~~ the acyclic unsaturated monomer (A2) is ~~be~~ an olefinic monomer ~~(Claim 3)~~. It is preferable that the thermoplastic elastomer (B) be at least one kind selected from an olefinic elastomer, polyamide elastomer, polyester elastomer, and styrenic elastomer (Claim 4). In addition, it is preferable that the melting point of the thermoplastic elastomer (B) be 60 to

190°C (Claim 5). It is preferable that the ratio (Ma/Mb) of a melt flow rate (Ma) of the alicyclic olefinic resin (A) and a melt flow rate (Mb) of the thermoplastic elastomer (B) be 0.1 to 20 (Claim 6). It is preferable that the ratio ((A)/(B)) of the alicyclic olefinic resin (A) and the thermoplastic elastomer (B) be 70/30 to 99.5/0.5 by weight ratio (Claim 7). Furthermore, the toner of the present invention is suitable as a toner for a non-magnetic one-component developing method (Claim 8). Additionally, the toner of the present invention is suitable as a toner for full color (Claim 9).

EFFECTS OF THE INVENTION

[0011] The toner of the present invention is a toner for developing electrostatic charge images which solves the above problem, and the viscoelastic property in the melted toner is suitable and fixability is superior since the binding resin contains an alicyclic olefinic resin (A) and a thermoplastic elastomer (B). Additionally, the toner of the present invention is also superior in melt contamination resistance in addition to the fixability.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] The toner of the present invention comprises at least a binding resin which contains an alicyclic olefinic resin (A) and a thermoplastic elastomer (B), and a colorant. In the following, these components will be explained in detail.

[0013] Alicyclic Olefinic Resin (A)

The alicyclic olefinic resin (A) ~~contains at least one kind of cyclic olefin (A1) and the following polymers (a), (b), (c), etc., can be employed. The polymer (a) is a homopolymer consisting of one kind of cyclic olefin (A1), the polymer (b) is a copolymer consisting of two kinds or more of cyclic olefin (A1),~~

~~and the polymer (c)~~ is copolymer consisting of cyclic olefin (A1) and acyclic unsaturated monomer (A2), and thereby it is superior in grindability, workability, mechanical properties, etc.

As a cyclic olefin (A1), cyclic olefinic compounds having at least one double bond and polycyclic olefinic compounds such as monocyclic olefins such as cyclobutene, cyclopentene, cyclohexene, cycloheptene, cyclooctene, etc., or derivatives thereof, cyclic conjugate dienes such as cyclopentadiene, cyclohexadiene, cycloheptadiene, cyclooctadiene, etc., or derivatives thereof, polycyclic olefins such as norbornene, dicyclopentadiene, tricyclodecene, tetracyclododecene, hexacycloheptadecene, etc., or these derivatives, vinylalicyclic hydrocarbons such as vinylcyclobutane, vinylcyclobutene, vinylcyclopentane, vinylcyclopentene, vinylcyclohexane, vinylcyclohexene, vinylcycloheptane, vinylcycloheptene, vinylcyclooctane, vinylcyclooctene, etc., or these derivatives, hydrides of aromatic ring part in vinylaromatic monomer such as styrene, etc., or these derivatives, or the like, can be employed. These cyclic olefins (A1) can be used alone or in combination. As an above derivative, alkyl substitutes, alkylidene substitutes, alkoxy substitutes, acyl substitutes, halogen substitutes, carboxyl substitutes, etc., can be used. The number of carbon atoms which constitute the alicyclic structure is generally 4 to 30, is preferably 5 to 20, and is more preferably 5 to 15, from the viewpoint of formability and transparency.

[0014] ~~The alicyclic olefinic resin (A) may be the homopolymer (a) consisting of one kind of cyclic olefin (A1) as an element and the copolymer (b) consisting of two kinds or more of cyclic olefin (A1) as an element; however, it is~~

~~preferable that the resin (A) be the copolymer (c) consisting of cyclic olefin (A1) and acyclic unsaturated monomer (A2) as an element, from the viewpoint of grindability, workability, mechanical properties, etc.~~

The acyclic unsaturated monomer (A2) is α-olefin having carbon number of 2 to 10, and thereby, flexibility is exhibited in the toner ~~not limited so long as it is an acyclic unsaturated monomer which can copolymerize with cyclic olefin (A1); however, as an acyclic unsaturated monomer (A2), for example, olefinic monomers; acrylic acid monomers; acrylate monomers such as acrylic acid C_{1-6} alkyl ester of methyl acrylate, ethyl acrylate, butyl acrylate, etc.; vinyl ester monomers such as vinyl acetate, vinyl propionic acid, etc.; vinyl cyanide monomers such as acrylonitrile, etc.; diene monomers such as butadiene, 1,4-pentadiene, isoprene, etc.; can be employed. These acyclic unsaturated monomers (A2) can be used alone or in combination. It is preferable that the acyclic unsaturated monomer (A2) be an olefinic monomer from the viewpoint of flexibility of the toner. Here, acrylic acid monomers, acrylate monomers, vinyl ester monomers, and vinyl cyanide monomers contain monomers in which a group at the α-position is substituted for alkyl group such as methyl, ethyl, butyl, etc~~.

As an α-olefin having carbon number of 2 to 10 ~~olefinic monomer~~, for example, an α-C_{2-10} olefin (preferably α-C_{2-6} olefin, and more preferably α-C_{2-4} olefin) such as ethylene, propylene, 1-butylene, 1-pentene, 1-hexene, 1-heptene, 1-octene, etc., and a branched-chain olefin such as isobutene, isoprene, etc., can be employed. These can be used alone or in combination. Of these olefins, ethylene and propylene are preferable.

An amount of the acyclic unsaturated monomer (A2) to be used can be selected from the range of 0 to 100 mol, preferably 0 to 90 mol, and more

decreased, and it is difficult to form uniform images.

[0039]The toner of the present invention is not limited as to developing method, and it can be used for a non-magnetic one-component developing method, a magnetic one-component developing method, a two-component developing method, or other developing methods. The toner for the magnetic one-component developing method is used as a magnetic toner by mixing the magnetic powder described in the above paragraph [0033] ~~[0032]~~ in the binding resin, and the toner for the two-component developing method is used by mixing with the carrier. The toner for the non-magnetic one-component developing method is preferably used from the viewpoint of simplicity of apparatus and production cost.

[0040]As a carrier used by the two-component developing method, for example, nickel, cobalt, iron oxide, ferrite, iron, glass bead, etc., can be used. These carriers can be used alone or in combination. It is preferable that the average particle diameter of the carrier be 20 to 150 μm. In addition, the surface of the carrier may be covered by coating materials such as fluorine resins, acrylic resins, silicone resins, etc.

[0041] The toner of the present invention may be a toner for monochrome or may be a toner for full color. In the toner for monochrome, as a colorant for non-magnetic toner, carbon black described in the above paragraph [0029] ~~[0028]~~ can be used, and as a colorant for magnetic toner, black magnetic powders of the magnetic powders described in the above paragraph [0033] ~~[0032]~~ can be used in addition to the carbon black described in the above paragraph [0029] ~~[0028]~~. In the toner for full color, as a colorant, the pigments

for color described in the above paragraph [0030] ~~[0029]~~ can be used.

[0042] Production Method of Toner

The production method for the toner of the present invention is not limited; however, melt-kneaded material is usually produced by dry-blending binding resin, colorant and other additives, and heat-kneading, and then toner having desired particle size and particle shape can be produced by crushing and classifying the melt-kneaded material. The production method of the toner may be a method in which toner particles are produced by polymerizing binding resin.

As a dry-type blending method, methods using mixing machines such as Henschel mixers, super mixers, ribbon mixers, etc., may be mentioned.

As a heat-melting and kneading method, various methods, for example, common methods such as methods using a biaxial extruder, methods using a Banbury mixer, methods using a pressure roller, methods using a pressure kneader, etc., can be used. The method using a biaxial extruder is preferable as a heat-melting and kneading method from the viewpoints of formability and generality. The melt-kneaded material is obtained by melting and kneading using a biaxial extruder and by pushing it out from a mouthpiece (die) of the tip of the biaxial extruder. The kneading temperature of the biaxial extruder is 50 to 220°C, is preferably 70 to 200°C, and is more preferably 80 to 180°C.

The alicyclic olefinic resin (A) and the thermoplastic elastomer (B) used in the present invention are superior in formability in production since superior dispersibility of each material component in heat-melting and kneading is considered.

As a crushing method, a crushing method using mills such as a hammer mill, cutter mill, jet mill, etc., can be employed.

In addition, as a classification method, air flow classifiers such as a dry-type centrifugal classifier can be generally used.

The volume average particle size of the toner as produced above is usual about 6 to 10 μm, is preferably 6 to 9 μm, and is more preferably 6 to 8 μm. The volume average particle size is volume 50% diameter measured using particle size distribution measuring device (trade name: Multisizer II, manufactured by Beckman Coulter Co., Ltd.).

The inorganic fine particles and the resin fine powders described in the above paragraphs [0037] and [0038] ~~[0036] and [0037]~~ may be adhered on the surface of the toner by agitating, using mixing machines such as turbine agitators, Henschel mixers, super mixers, etc.

[0043] EXAMPLES

In the following, effects of the present invention are explained in detail by Examples based on the present invention; however, the present invention is not limited by these Examples. In the following, material components used in Examples and Comparative Examples, measuring methods of physical properties, and evaluation methods for the toners are given.

Material Component

Binding Resin

CO: alicyclic olefinic resin (ethylene-norbornene copolymer, produced by Ticona GmbH, trade name: TOPAS COC, weight average molecular (Mw): 200,000, number average molecular weight (Mn): 5,000, and Mw/Mn: 40)

CLAIMS

1. (amended) A toner for developing electrostatic charge images, comprising at least binder resin and colorant,

wherein the binding resin contains alicyclic olefinic resin (A) and thermoplastic elastomer (B),

the alicyclic olefinic resin (A) is a copolymer comprising cyclic olefin (A1) and acyclic unsaturated monomer (A2) as an element, and

the acyclic unsaturated monomer (A2) is an olefinic monomer.

2. (canceled) ~~A toner for developing electrostatic charge images according to claim 1, wherein the alicyclic olefinic resin (A) is a copolymer comprising cyclic olefin (A1) and acyclic unsaturated monomer (A2) as an element.~~

3. (canceled) ~~A toner for developing electrostatic charge images according to claim 2, wherein the acyclic unsaturated monomer (A2) is an olefinic monomer.~~

4. A toner for developing electrostatic charge images according to claim 1, wherein the thermoplastic elastomer (B) is at least one kind selected from olefinic elastomer, polyamide elastomer, polyester elastomer, and styrenic elastomer.

5. A toner for developing electrostatic charge images according to claim 1, wherein a melting point of the thermoplastic elastomer (B) is from 60 to 190°C.

6. A toner for developing electrostatic charge images according to claim 1, wherein a ratio (Ma/Mb) of a melt flow rate (Ma) of the alicyclic olefinic resin (A) and a melt flow rate (Mb) of the thermoplastic elastomer (B) is 0.1 to 20.

7. A toner for developing electrostatic charge images according to claim 1, wherein a ratio ((A)/(B)) between the alicyclic olefinic resin (A) and the thermoplastic elastomer (B) is 70/30 to 99.5/0.5 by weight ratio.

8. A toner for developing electrostatic charge images according to claim 1, wherein the toner is a toner for a non-magnetic one-component developing method.

9. A toner for developing electrostatic charge images according to claim 1, wherein the toner is suitable for a toner for full color.